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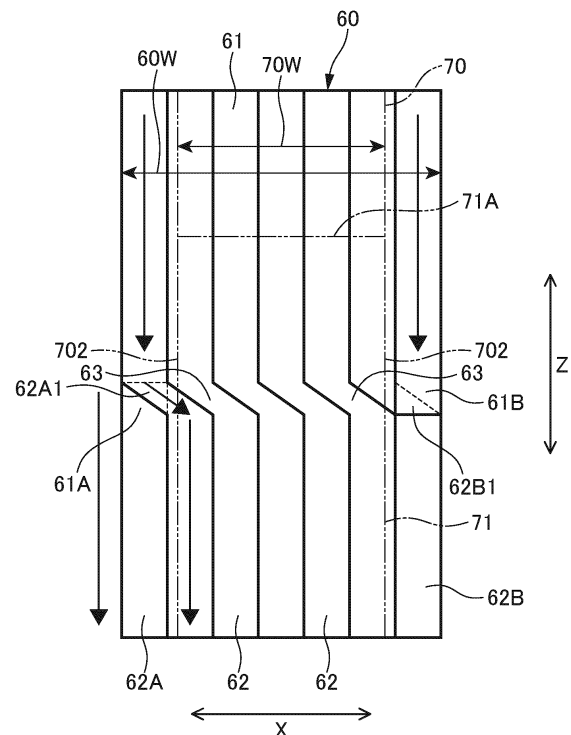
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(54) **PNEUMATIC TIRE AND METHOD FOR PRODUCING SAME**

(57) Provided is a pneumatic tire which makes it possible to suppress variation in thickness of a sealant layer by reducing overlapping regions of a sealant material, and achieve improvement in the adhesiveness of a sound absorption layer with respect to the sealant layer. The present invention is provided with: a sealant layer 60 disposed to the tire internal cavity side of an inner liner 50; and a sound absorption layer 70 disposed to the tire internal cavity side of the sealant layer 60. The sealant layer 60 is formed from a belt-shaped sealant material 61 that is stuck to an inner surface 501 of the inner liner 50 while being rotated. The sealant layer 60 has: a plurality of annular circulation parts 62 that are in parallel to the tire circumferential direction and that are disposed in parallel to each other in a state where the sealant material 61 is disposed adjacent to the same in the tire width direction; and a plurality of shift parts 63 which are each provided to a portion of a circulation part 62 in the tire circumferential direction and at each of which the sealant material 61 is shifted to a circulation part 62 located adjacent on one side in the tire width direction.

FIG. 2



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Description

TECHNICAL FIELD

[0001] The present invention relates to a pneumatic tire for vehicles and a method for producing this.

BACKGROUND ART

[0002] Conventionally, a pneumatic tire has been known which includes a puncture prevention function whereby a hole in the tire formed during puncture is automatically plugged by a sealant layer provided to the inner surface of the tire. For example, Patent Document 1 discloses a pneumatic tire in which a sealant layer is formed by a substantially cord-like sealant material arranged by continuously coating in a spiral shape along the tire inner surface, and a sound absorbing layer is provided to the inner side of the sealant layer.

[0003] Patent Document 1: Japanese Patent No.6184523

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

[0004] When coating the sealant material in a spiral shape, an area in which sealant material overlaps exists long in the circumferential direction, at both ends in the tire-width direction, which is an initial circling portion and a final circling portion. If the overlap area of the sealant material is large, defects will arise such as variation in the thickness of the sealant layer increasing, and leading to a decline in the adhesiveness of the sound absorbing layer to the sealant layer.

[0005] The present invention has been made taking account of the above situation, and has an object of providing a pneumatic tire and a method for producing the same whereby an overlap area of a sealant material decreases, variation in thickness of the sealant layer is suppressed, and an improvement in adhesiveness of a sound absorbing layer to the sealant layer is achieved.

Means for Solving the Problems

[0006] A pneumatic tire according to the present invention includes: a pair of beads; a pair of sidewalls extending from each of the pair of beads to an outer side in a tire-radial direction; a tread disposed between the pair of sidewalls; a carcass ply bridged between the pair of beads; an inner liner disposed at a tire inner cavity side of the carcass ply; a sealant layer disposed at an inner surface of the tire inner cavity side corresponding to at least the tread of the inner liner; and a sound absorbing layer disposed at a tire inner cavity side of the sealant layer, in which the sealant layer is formed from a belt-like sealant material pasted while circling the inner surface of the inner liner, the sealant layer includes: a plurality of

annular circling parts parallel to a tire-circumferential direction in which the sealant material is disposed in parallel in a state adjacent in the tire-width direction, and a plurality of transition parts provided to a part in the tire-circumferential direction of the circling part, and at which the sealant material transitions to the circling part adjacent at one side in the tire-width direction.

[0007] A method for producing the pneumatic tire according to the present invention forms a sealant layer on an inner surface of a tire, and then disposes a sound absorbing layer on a tire inner cavity side of the sealant layer, the method including forming a sealant layer, while continuously rotating the tire around its axis upon forming the sealant layer, by repeating an operation of discharging a sealant material from a nozzle disposed at the tire inner cavity side onto an inner surface of the tire to form annular circling parts parallel to a tire-circumferential direction from the sealant material, then relatively moving the nozzle in the tire-width direction relative to the tire, while discharging the sealant material from the nozzle, followed by discharging the sealant material from the nozzle onto the inner surface of the tire, thereby forming from the sealant material, on one side in the tire-width direction of said circling part, a next circling part adjacent to said circling part to form on an inner surface of the tire a sealant layer in which a plurality of the circling parts are arranged in parallel in the tire-width direction.

Effects of the Invention

[0008] According to the present invention, it is possible to provide a pneumatic tire and a method for producing the same whereby an overlap area of a sealant material decreases, variation in thickness of the sealant layer is suppressed, and an improvement in adhesiveness of a sound absorbing layer to the sealant layer is achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a cross-sectional view in a tire-width direction of the tire according to an embodiment of the present invention;

Fig. 2 is a development view showing an inner surface of the tire according to the embodiment of the present invention, and schematically showing a sealant layer and sound absorbing layer;

Fig. 3 is a view schematically showing a state of coating a sealant material on a tire inner surface by a nozzle, upon producing the tire according to the embodiment of the present invention; and

Fig. 4 is a development view of a tire inner surface schematically showing a conventional example of pasting a sealant material in a spiral shape onto the tire inner surface.

PREFERRED MODE FOR CARRYING OUT THE INVENTION

[0010] Hereinafter, an embodiment will be explained while referencing the drawings. Fig. 1 is a view showing a tire-width direction cross section of a tire 1, which is a pneumatic tire according to the present embodiment. The tire 1 is a tire for a passenger vehicle, for example. The specific structure of the tire 1 is left/right symmetrical in a cross section in the tire-width direction. In the drawings, reference symbol S1 is a tire equatorial plane. The tire equatorial plane S1 is a plane intersecting a tire rotational axis (tire meridian axis), and is positioned at the center in the tire-width direction.

[0011] It should be noted that the cross-sectional view of Fig. 1 is a tire-width direction cross-sectional view (tire meridian axis cross-sectional view) of an unloaded state in which the tire 1 is mounted to a standard rim and filled with standard internal pressure. It should be noted that standard rim indicates a rim serving as a standard decided by JATMA corresponding to the tire size. In addition, standard internal pressure is 180 kPa in the case of the tire being for a passenger vehicle, for example.

[0012] Herein, tire-width direction is a direction parallel to the tire rotational axis, and is the left/right direction in the paper plane in the cross-sectional view of Fig. 1. In Fig. 1, it is illustrated as the tire-width direction X. Then, the tire-width direction inner side is a direction near the tire equatorial plane S1, and is the central side in the paper plane of Fig. 1. Tire-width direction outer side is a direction distanced from the tire equatorial plane S1, and is the left side and right side in the paper plane of Fig. 1. In addition, tire-radial direction is a direction perpendicular to the tire rotational axis, and is the vertical direction in Fig. 1. In Fig. 1, it is illustrated as the tire-radial direction Y. Then, a tire-radial direction outer side is a direction distanced from the tire rotational axis, and is a lower side in the paper plane of Fig. 1. Tire-radial direction inner side is a direction approaching the tire rotational axis, and is an upper side in the paper plane of Fig. 1.

[0013] As shown in Fig. 1, the tire 1 includes: a pair of beads 10 provided at both sides in the tire-width direction; a pair of sidewalls 20 extending from each of the pair of beads 10 to the outer side in the tire-radial direction; tread 30 arranged between the pair of sidewalls 20; a carcass ply 40 arranged between the pair of beads 10; and an inner liner 50 arranged on the tire inner cavity side of the carcass ply 40.

[0014] The bead 10 includes a bead core 11, bead filler 12 extending in the tire-radial direction outer side of the bead core 11, a chafer 13, and rim strip rubber 14.

[0015] The bead core 11 is an annular member formed by winding a bead wire made of metal covered with rubber around several times, and is a member playing the role of fixing the tire 1 filled with air to the rim. The bead filler 12 is a rubber member which takes on a tapered shape as extending to the outer side in the tire radial direction. The bead filler 12 is a member provided to raise

the rigidity of a circumferential portion of the bead 10, and ensure high maneuverability and stability. The bead filler 12, for example, is configured from rubber having higher hardness than the surrounding rubber members.

[0016] The chafer 13 is provided to the inner side in the tire-radial direction of the carcass ply 40 provided around the bead core 11. The rim strip rubber 14 is arranged on the outer side in the tire-width direction of the chafer 13 and carcass ply 40. The rim strip rubber 14 is a member which contacts the rim to which the tire 1 is mounted.

[0017] The sidewall 20 includes sidewall rubber 21 arranged on the outer side in the tire-width direction of the carcass ply 40. The sidewall rubber 21 configures an outer wall surface of the tire 1. The sidewall rubber 21 is a portion which bends the most upon the tire 1 exhibiting a cushioning action, and usually flexible rubber having fatigue resistance is adopted therein.

[0018] The tread 30 includes an endless belt 31 and cap ply 32, and tread rubber 33.

[0019] The belt 31 is arranged at an outer side in the tire-radial direction of the carcass ply 40. The cap ply 32 is arranged at an outer side in the tire-radial direction of the belt 31. The belt 31 is a member reinforcing the tread 30. The belt 31 in the present embodiment is a two-layer structure including a belt 311 on the inner side and a belt 312 on the outer side. The belt 311 on the inner side and the belt 312 on the outer side both have a structure in which a plurality of cords such as steel cords is covered with rubber. It should be noted that the belt 31 is not limited to a two-layer structure, and may have a structure of one layer or three or more layers.

[0020] The cap ply 32 is a member reinforcing the tread 30 together with the belt 31. The cap ply 32, for example, has a structure in which a plurality of organic fiber cords having an insulation property such as polyimide fibers is covered with rubber. By providing the cap ply 32, it is possible to achieve an improvement in durability and a reduction in road noise during travel.

[0021] The tread rubber 33 is arranged on the outer side in the tire-radial direction of the cap ply 32. The tread rubber 33 is a member constituting the tire tread (contact surface with road surface) 331 during normal travel. A tread pattern 34 configured by a plurality of grooves, for example, is provided in the tire tread 331 of the tread rubber 33. The tread pattern 34 has a plurality of main grooves 341 aligned in the tire-width direction. Each of the plurality of main grooves 341 extends along the tire circumferential direction.

[0022] The carcass ply 40 configures a ply serving as the backbone of the tire 1. The carcass ply 40 is embedded within the tire 1, in a form passing through the pair of sidewalls 20 and the tread 30 between the pair of beads 10. The carcass ply 40 includes a plurality of carcass cords serving as the backbone of the tire 1. The plurality of carcass cords extends in the tire-width direction, for example, and are arranged side by side in the tire-circumferential direction. This carcass cord is configured

from an insulative organic fiber cord such as polyester or polyamide, or the like. The plurality of carcass cords is coated by rubber, whereby the carcass ply 40 is configured.

[0023] The carcass ply 40 includes a ply main body part 401 which extends from one bead core 11 to the other bead core 11, and extends between the tread 30 and bead 10; a pair of elbow-shaped bends 402 which fold back from the ply main body part 401 at the bead core 11; and a pair of folding parts 403 which extend from each of the elbow-shaped bends 402 to an outer side in the tire-radial direction. The ply main body part 401, the elbow-shaped bend 402 and folding part 403 are continuous.

[0024] The ply main body part 401 is arranged at the inner side in the tire-width direction of the bead core 11 and bead filler 12 on the inner side in the tire-radial direction. The folding part 403 is arranged at the outer side in the tire-width direction of the bead core 11 and bead filler 12 at the inner side in the tire-radial direction. In a portion other than the bead core 11 and bead filler 12, the folding part 403 is overlapped with the ply main body part 401. The elbow-shaped bend 402 configures a portion most to the inner side in the tire-radial direction of the carcass ply 40.

[0025] The carcass ply 40 of the present embodiment is a one-layer structure; however, the carcass ply 40 is not limited to a one-layer structure, and may have a two-layer or three or more layer-structure.

[0026] The aforementioned chafer 13 of the bead 10 is provided so as to surround the end on the inner side in the tire-radial direction of the carcass ply 40 including the elbow-shaped bend 402. In addition, the rim strip rubber 14 is arranged at the outer side in the tire-width direction of the chafer 13 and the folding part 403 of the carcass ply 40. The end on the outer side in the tire-radial direction of the rim strip rubber 14 is covered by the aforementioned sidewall rubber 21.

[0027] The inner liner 50 covers the tire inner surface between the pair of beads. The inner liner 50 covers the inner surface of the ply main body part 401 of the carcass ply 40 and the inner surface of the chafer 13 of the pair of beads 10. The inner liner 50 is configured by air permeation resistant rubber, whereby the air inside the tire inner cavity is prevented from leaking to outside.

[0028] As shown in Fig. 1, the tire 1 according to the present embodiment further includes the sealant layer 60 and sound absorbing layer 70.

[0029] The sealant layer 60 is arranged at the inner surface 501 on the tire inner cavity side corresponding to at least the tread 30 of the inner liner 50. The width of the sealant layer 60, i.e. length dimension in the tire-width direction, is set to about 1.1 times the width of the tire tread 331 of the tread 30 serving as the contact width of the tire 1, for example. The sealant layer 60 may be arranged so as to overhang from the tread 30 to the outer side in the tire-width direction, and include part on the side of the tread 30 of the sidewall 20. The sealant layer

60 is pasted to the inner liner 50 by the stickiness inherent thereto. The thickness of the sealant layer 60 is on the order of 1 mm or greater and 10 mm or less, for example. The sound absorbing layer 70 is arranged at the inner surface 601 on the tire inner cavity side of the sealant layer 60. The sound absorbing layer 70 is pasted to the sealant layer 60 by way of the stickiness of the sealant layer 60.

[0030] Fig. 2 is a development view showing the inner surface of the tire 1, and schematically shows the sealant layer 60 and sound absorbing layer 70 provided to the inner surface of the tire 1. Fig. 2 shows the tire-width direction by the arrow X, and shows the tire-circumferential direction by the arrow Z.

[0031] As shown in Fig. 2, the sealant layer 60 is formed from one belt-like sealant material 61 pasted while circling along the tire-circumferential direction to the inner surface 501 of the inner liner 50. The sealant layer 60 has a plurality of annular circling parts 62 and a plurality of transition parts 63 formed by the sealant material 61.

[0032] In Fig. 2, the reference symbol 61A indicates the pasting starting end of the sealant material 61, and reference symbol 61B indicates the pasting finishing end of the sealant material 61. As shown in Fig. 2, the sealant material 61 is continuously pasted from one end side in the tire-width direction to the other end side (left side to right side in Fig. 2), while circling to configure as shown by the arrow in the middle drawing, from the pasting starting end 61A until the pasting finishing end 61B.

[0033] The circling part 62 is formed by the sealant material 61 being pasted on the inner surface 501 of the inner liner 50 in parallel to the tire-circumferential direction. A plurality of circling parts 62 are arranged in parallel so as to be adjacent in a state in close proximity with each other in the tire-width direction. The plurality of transition parts 63 slope with a predetermined angle relative to the tire-circumferential direction, and are arranged in parallel so as to be adjacent in a state in close proximity with each other.

[0034] The transition part 63 is provided to a part in the tire-circumferential direction of the circling part 62. The transition part 63 is a portion at which the sealant material 61 transitions to one side in the tire-width direction (right side in Fig. 2), after one circling part 62 is formed by the sealant material 61 being pasted approximately once around the inner surface 501 of the inner liner 50. In other words, the transition part 63 is a portion provided to part of the circling part 62, and connects adjacent circling parts 62 in the tire-width direction to form an angle relative to the tire-circumferential direction. The next circling part 62 is pasted adjacent on one side in the tire-width direction of the already pasted circling part 62 through the transition part 63. The next circling part 62 adjacent on one side in the tire-width direction through the transition part 63 is repeatedly formed, whereby the sealant layer 60 is provided. In the present embodiment, the plurality of transition parts 63 are respectively arranged at approx-

imately the same position in the tire-circumferential direction, and arranged in parallel in the tire-width direction.

[0035] In this way, upon pasting the sealant material 61 to the tire inner surface, the pasting method of sequentially pasting in the tire-width direction the circling parts 62 parallel in the tire-circumferential direction while passing through the transition parts 63 may be referred to as step pasting below.

[0036] As the sealant material 61, for example, it is possible to use a sealing member having stickiness made by blending a plasticizer such as polyisobutylene and polybutene, a tackifier such as a thermoplastic olefin/diolefin copolymer, and a filler such as carbon black and silica, into unvulcanized or semi-vulcanized butyl rubber, for example. It should be noted that, not limiting thereto, the sealant material 61 may be another known sealing member that is being used conventionally.

[0037] Next, the method of producing the tire according to the present embodiment including step pasting the sealant material 61 will be explained. To step paste the sealant material 61, it is possible to perform by discharging and coating the sealant material 61 onto the inner surface 501 of the inner liner 50, which is the inner surface of the tire 1, from the nozzle 100, while rotating the tire 1 around its axis, and moving the nozzle 100 in the tire-width direction, as shown in Fig. 3. The nozzle 100 is attached to the leading end of an extruder (not shown), and is inserted to the inner side of the tire 1. The sealant material 61 extruded from this extruder is discharged and coated on the inner surface of the tire 1 from the leading end of the nozzle 100. In Fig. 3, the width-direction cross section of the tire 1 is shown, and the tire-width direction X, tire-radial direction Y and tire-circumferential direction Z are each shown. In Fig. 3, the reference symbol G is the axis of rotation of the tire 1.

[0038] One circling part 62 is coated by rotating the tire 1 approximately one time in a state stopping movement in the tire-width direction, while discharging the sealant material 61 continuously from the nozzle 100, and while continuously rotating the tire 1 around its axis. Next, when moving the nozzle 100 to one side in the tire-width direction by the width of the sealant material 61, the transition part 63 is coated meanwhile. Next, the movement in the tire-width direction is stopped, and the circling part 62 next to the previously coated circling part 62 is coated. By repeating the above operation, it is possible to step paste the sealant material 61 onto the formation area of the sealant layer 60. When coating and pasting the sealant material 61 to the entirety of the formation area of the sealant layer 60, discharge of sealant material 61 from the nozzle 100 stops. The sealant layer 60 is formed by the sealant material 61 in this way, and the sound absorbing layer 70 is subsequently arranged on the tire inner cavity side of the sealant layer 60.

[0039] In the case of the sealant material 61 being step pasted to the inner surface 501 of the inner liner 50 in the above way, the initial circling part 62A on one end side in the tire-width direction (left side in Fig. 2) formed

first among the plurality of circling part 62 has a first circling overlap part 62A1 which overlaps in the tire-thickness direction at the transition part 63 to the next circling part 62 from the initial circling part 62A, as shown in Fig. 2. In addition, the finishing circling part 62B on the other end side in the tire-width direction (right side in Fig. 2) formed last has a circling overlap part 62B1 which overlaps in the tire-thickness direction with the transition part 63 transitioning to the finishing circling part 62B. The first circling overlap part 62A1 is a portion at which the transition part 63 overlaps over the pasting start end 61A. The second circling overlap part 62B1 is a portion at which the pasting finish end 61B overlaps over the transition part 63.

[0040] The sound absorbing layer 70 is formed with a sound absorbing material 71 consisting of sponge or the like formed with foaming material. The sound absorbing material 71 is an interconnecting foam body including several pores, and having permeability with outside air. As such a material, for example, flexible urethane foam can be exemplified.

[0041] The sound absorbing layer 70 is pasted by at least one sheet of sound absorbing material 71 being wound in a ring shape on the inner surface 601 of the sealant layer 60. As shown in Fig. 2, the sound absorbing material 71 has a joint 71A at which circulation-direction ends opposing each other are joined. It should be noted that the sound absorbing layer 70 may be configured by at least two sound absorbing materials 71 being arranged in a state linked in a ring shape.

[0042] As characteristics of the sound absorbing material 71, from the viewpoint of weight balance of the pneumatic tire, it preferably has density no greater than 60 kg/m^3 , and more preferably has density no greater than 40 kg/m^3 . In addition, the sound absorbing material 71, from the viewpoint of durability, preferably has a tensile strength of at least 30 kPa, and a tear strength of at least 2.0 N/cm (JIS K6400-5).

[0043] The dimension 70W in the tire-width direction of the sound absorbing layer 70 is preferably at least 90% to 100% relative to the dimension 60W in the tire-width direction of the sealant layer 60. Then, the sound absorbing layer 70 is preferably arranged so as to fit within the tire-width direction of the sealant layer 60. Furthermore, each of both tire-width direction ends 702 of the sound absorbing layer 70 is preferably located more to the inner side in the tire-radial direction than the first circling overlap part 62A1 and second circling overlap part 62B1 of the sealant layer 60, and not overlapping each other.

[0044] In addition, it is preferable for the position of the joint 71A of the sound absorbing layer 70 and the position of the first circling overlap part 62A1 and second circling overlap part 62B1 of the sealant layer 60 to be shifted in the tire-circumferential direction and not to overlap each other.

[0045] According to the tire 1 of the aforementioned embodiment, in the case of a nail or the like poking the tread 30, for example, and a hole that reaches the sealant

layer 60 occurring, this hole is automatically plugged by the sealant layer 60, and the puncture is prevented before it happens. In addition, the road noise during travel is absorbed by the sound absorbing layer 70 and decreases.

[0046] According to the tire 1 of the present embodiment explained above, the following effects are exerted.

(1) The tire 1 according to the present embodiment includes: a pair of beads 10; a pair of sidewalls 20 extending from each of the pair of beads 10 to an outer side in the tire-radial direction; a tread 30 arranged between the pair of sidewalls 20; a carcass ply 40 bridged between the pair of beads 10; an inner liner 50 arranged on the tire inner cavity side of the carcass ply 40; a sealant layer 60 arranged on the inner surface 501 on the tire inner cavity side corresponding to at least the tread 30 of the inner liner 50; and a sound absorbing layer 70 arranged on the tire inner cavity side of the sealant layer 60, in which the sealant layer 60 is formed from a belt-like sealant material 61 pasted while circling the inner surface 501 of the inner liner 50, and the sealant layer 60 has a plurality of annular circling parts 62 parallel to the tire-circumferential direction in which the sealant material 61 are arranged in parallel in a state adjacent in the tire-width direction, and a plurality of transition parts 63 provided to a part in the tire-circumferential direction of the circling part 62, and in which the sealant material 61 transitions to an adjacent circling part 62 on one side in the tire-width direction.

[0047] Since the overlap area of the sealant material 61 drastically decreases compared to a conventional case of winding in a spiral shape, in the sealant layer 60, variation in thickness is suppressed, and unevenness decreases, whereby an improvement in adhesion of the sound absorbing layer 70 to the sealant layer 60 is achieved.

[0048] Fig. 4 shows an example of coating the sealant material 61 in a spiral shape. According to this, the region in which adjacent sealant material 61 wound in a spiral shape overlap (shown by the hatched area in the drawing) exist long in the circumferential direction, in the initial circling part 82A along the tire-circumferential direction on the left end in the tire-width direction in the drawing, and the final circling part 82B along the tire-circumferential direction on the right end. If the overlap area of the sealant material 61 is large in this way, defects arise such that the variation in thickness of the sealant layer becomes greater, and leads to a decline in adhesiveness of the sound absorbing layer to the sealant layer. In contrast, by performing step pasting which aligns in the tire-width direction the circling parts 62 parallel to the tire-circumferential direction, without circling the sealant material 61 in a spiral shape in the present embodiment, it is possible to drastically decrease the overlap area of the sealant material 61 in the aforementioned way.

[0049] (2) In the tire 1 according to the present embodiment, the dimension in the tire-width direction of the sound absorbing layer 70 is at least 90% to 100% relative to the dimension in the tire-width direction of the sealant layer 60, and the sound absorbing layer 70 is arranged so as to fit within the tire-width direction of the sealant layer 60.

[0050] It is thereby possible to reduce the surface area of a portion not covered by the sound absorbing layer 70 of the sealant layer 60, and possible to suppress clinging of debris to the sealant layer 60 having stickiness. In addition, since the tire-width direction end of the sound absorbing layer 70 clings to the sealant layer 60, the sound absorbing layer 70 hardly peels from the sealant layer 60, and the sound absorbing performance is maintained.

[0051] (3) In the tire 1 according to the present embodiment, the initial circling part 62A on one end side in the tire-width direction and a final circling part 62B on another end side in the tire-width direction among the plurality of circling parts 62 of the sealant layer 60 have a first circling overlap part 62A1 and second circling overlap part 62B1 which overlap in the tire-thickness direction at the transition part 63; the sound absorbing layer 70 is formed by sound absorbing material 71 wound along the tire-circumferential direction on the inner surface 601 of the sealant layer 60 and having the joint part 71A at which circumferential-direction ends opposing each other join; and positions in the tire-circumferential of the joint part 71A of the sound absorbing layer 70 and the first circling overlap part 62A1 and second circling overlap part 62B1 of the sealant layer 60 differ.

[0052] Since the joint part 71A of the sound absorbing layer 70, and first circling overlap part 62A1 and second circling overlap part 62B1 of the sealant layer 60 thereby do not overlap, the joint part 71A of the sound absorbing layer 70 will hardly peel from the sealant layer 60, and adhesiveness of the sound absorbing layer 70 to the sealant layer 60 is maintained.

[0053] (4) In the tire 1 according to the present embodiment, the initial circling part 62A on one end side in the tire-width direction and the final circling part 62B on another end side in the tire-width direction among the plurality of circling parts 62 of the sealant layer 60 have the first circling overlap part 62A1 and second circling overlap part 62B1 which overlap in the tire-thickness direction at the transition part 63; and each of both tire-width direction ends 702 of the sound absorbing layer 70 is located more to the inner side in the tire-width direction than the first circling overlap part 62A1 and second circling overlap part 62B1 of the sealant layer 60.

[0054] Since both tire-width direction ends 702 of the sound absorbing layer 70 thereby do not overlap the first circling overlap part 62A1 and second circling overlap part 62B1 of the sealant layer 60, both tire-width direction ends 702 of the sound absorbing layer 70 will hardly peel from the sealant layer 60, and adhesiveness of the sound absorbing layer 70 to the sealant layer 60 is maintained.

[0055] (5) The method for producing the pneumatic

tires according to the present embodiment includes: forming the sealant layer on the inner surface 501 of the inner liner 50, which is an inner surface of the tire 1, followed by arranging the sound absorbing layer 70 on the tire inner cavity side of the sealant layer 60, the method including forming the sealant layer 60, while continuously rotating the tire 1 around its axis upon forming the sealant layer 60, by repeating an operation of discharging a sealant material 61 from a nozzle 100 disposed at the tire 1 inner cavity side onto an inner surface of the tire 1 to form annular circling parts 62 parallel to a tire-circumferential direction from the sealant material 61, then relatively moving the nozzle 100 in the tire-width direction relative to the tire 1, while discharging the sealant material 61 from the nozzle 100, followed by discharging the sealant material 61 from the nozzle 100 onto the inner surface of the tire 1, thereby forming from the sealant material 61, on one side in the tire-width direction of said circling part 62, a next circling part 62 adjacent to said circling part 62 to form on an inner surface of the tire 1 a sealant layer 60 in which a plurality of the circling parts 62 are arranged in parallel in the tire-width direction.

[0056] Since the overlap area of the sealant material 61 in the sealant layer 60 drastically decreases compared to the conventional case of winding in a spiral shape, variation in thickness is suppressed, and unevenness decreases, whereby an improvement in adhesion of the sound absorbing layer 70 to the sealant layer 60 is achieved.

[0057] Although a specific embodiment of the present invention has been explained above, the present invention is not limited to the above embodiment, and even if carrying out modifications, improvements and the like in a scope that can achieve the object of the present invention, are included in the scope of the present invention. For example, the plurality of circling parts 62 of the sealant layer 60 are formed by circling around once the sealant material 61 and pasting; however, it may be configured to obtain a predetermined thickness with the circling number as a few times. In addition, it may be a mode in which the sound absorbing material 71 forming the sound absorbing layer 70 joins a plurality of pieces divided in the tire-radial direction. In the case of step pasting the sealant material 61 to form a plurality of circling parts 62, the tire 1 may be moved in the tire-width direction, or both the tire 1 and nozzle 131 maybe moved in the tire-width direction, instead of moving the nozzle 100 in the tire-width direction.

EXPLANATION OF REFERENCE NUMERALS

[0058]

- 1 tire (pneumatic tire)
- 10 bead
- 20 sidewall
- 30 tread
- 40 carcass ply

- 50 inner liner
- 60 sealant layer
- 61 sealant material
- 62 circling part
- 5 62A initial circling part
- 62A1 first circling overlap part
- 62B final circling part
- 62B1 second circling overlap part
- 63 transition part
- 10 70 sound absorbing layer
- 71A joint

Claims

1. A pneumatic tire comprising:

- a pair of beads;
- a pair of sidewalls extending from each of the pair of beads to an outer side in a tire-radial direction;
- a tread disposed between the pair of sidewalls;
- a carcass ply bridged between the pair of beads;
- an inner liner disposed at a tire inner cavity side of the carcass ply;
- a sealant layer disposed at an inner surface of the tire inner cavity side corresponding to at least the tread of the inner liner; and
- a sound absorbing layer disposed at a tire inner cavity side of the sealant layer,
- wherein the sealant layer is formed from a belt-like sealant material pasted while circling the inner surface of the inner liner,
- wherein the sealant layer includes: a plurality of annular circling parts parallel to a tire-circumferential direction in which the sealant material is disposed in parallel in a state adjacent in the tire-width direction, and
- a plurality of transition parts provided to a part in the tire-circumferential direction of the circling part, and at which the sealant material transitions to the circling part adjacent at one side in the tire-width direction.

2. The pneumatic tire according to claim 1, wherein a dimension in the tire-width direction of the sound absorbing layer is at least 90% to 100% relative to a dimension in the tire-width direction of the sealant layer, and the sound absorbing layer is disposed so as to fit within the tire-width direction of the sealant layer.

3. The pneumatic tire according to claim 1 or 2, wherein an initial circling part on one end side in the tire-width direction and a final circling part on another end side in the tire-width direction among the plurality of circling parts respectively have a circling overlap part which overlap in the tire-thickness direction at the

transition part,

wherein the sound absorbing layer is formed from a sound absorbing material wound along the tire-circumferential direction on the inner surface of the sealant layer and having a joint part at which circumferential-direction ends opposing each other join, and wherein positions of the joint part and the circling overlap part differ in the tire-circumferential direction.

4. The pneumatic tire according to any one of claims 1 to 3, wherein an initial circling part on one end side in the tire-width direction and a final circling part on another end side in the tire-width direction among the plurality of circling parts respectively have a circling overlap part which overlap in the tire-thickness direction at the transition part, and wherein both tire-width direction ends of the sound absorbing layer are located more to an inner side in the tire-width direction than the circling overlap part.

5. The pneumatic tire according to any one of claims 1 to 4, wherein a plurality of the transition parts are respectively disposed at substantially the same position in the tire-circumferential direction, and disposed in parallel in the tire-width direction.

6. A method for producing a pneumatic tire which forms a sealant layer on an inner surface of a tire, and then disposes a sound absorbing layer on a tire inner cavity side of the sealant layer, the method comprising: forming a sealant layer,

while continuously rotating the tire around its axis upon forming the sealant layer, by repeating an operation of discharging a sealant material from a nozzle disposed at the tire inner cavity side onto an inner surface of the tire to form annular circling parts parallel to a tire-circumferential direction from the sealant material, then relatively moving the nozzle in the tire-width direction relative to the tire, while discharging the sealant material from the nozzle, followed by discharging the sealant material from the nozzle onto the inner surface of the tire, thereby forming from the sealant material, on one side in the tire-width direction of said circling part, a next circling part adjacent to said circling part to form on an inner surface of the tire a sealant layer in which a plurality of the circling parts are arranged in parallel in the tire-width direction.

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FIG. 3

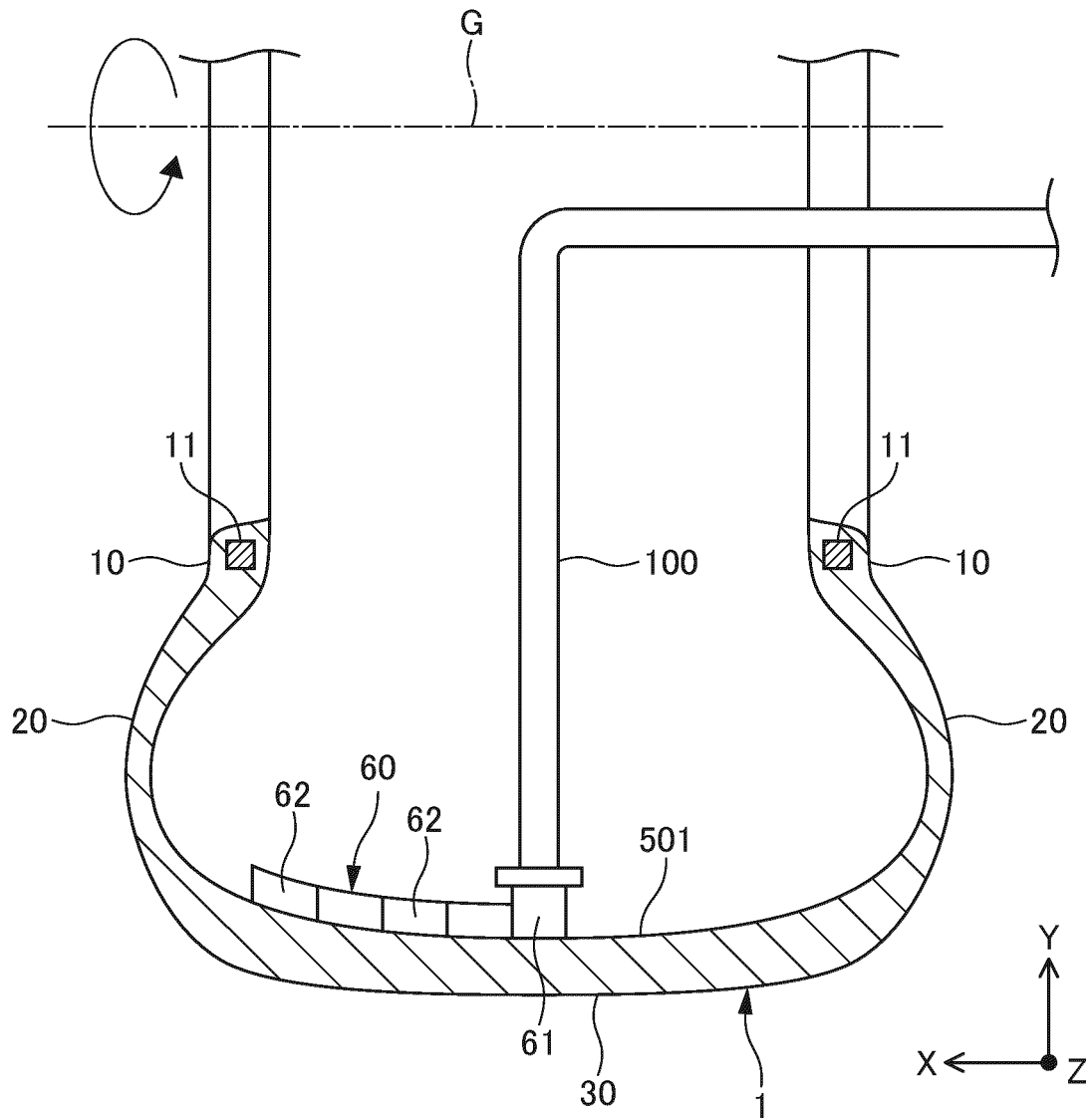
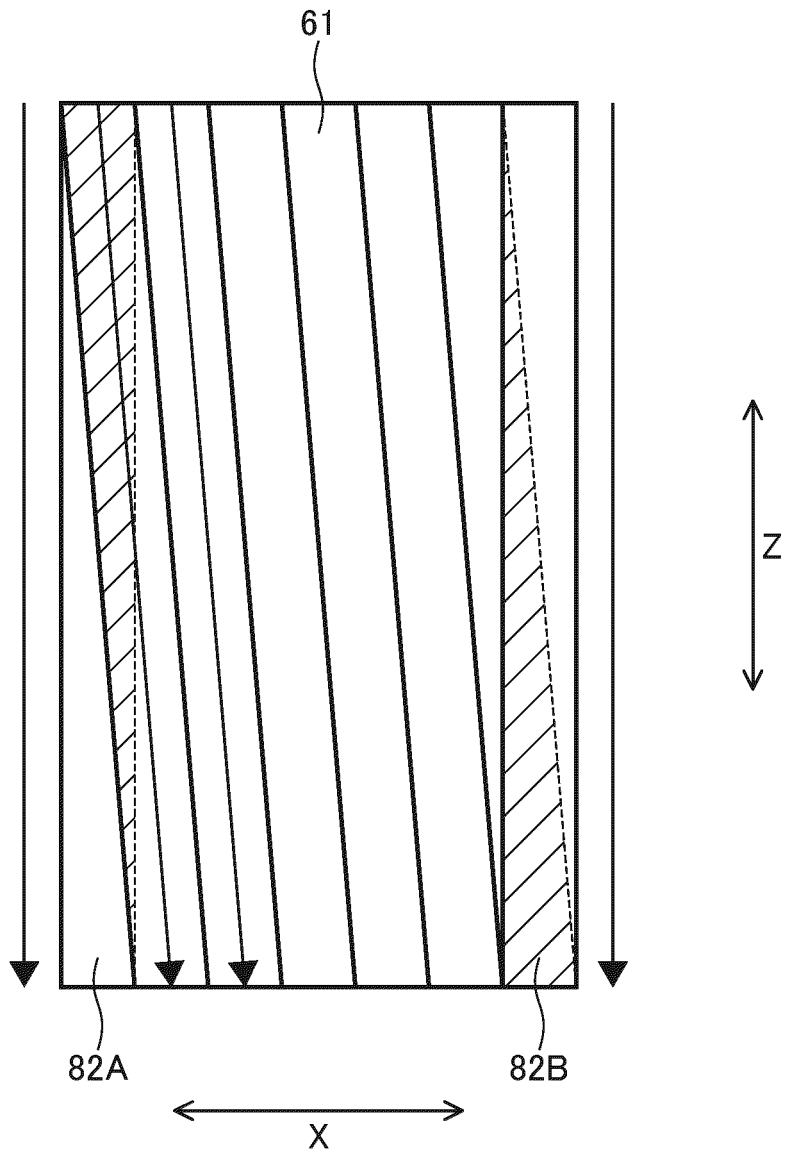


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/041856

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A. CLASSIFICATION OF SUBJECT MATTER		
<p>B60C 19/12(2006.01)i; B29D 30/06(2006.01)i; B60C 5/00(2006.01)i FI: B60C19/12 A; B29D30/06; B60C5/00 F</p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>		
B. FIELDS SEARCHED		
<p>Minimum documentation searched (classification system followed by classification symbols) B60C1/00-19/12</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2022 Registered utility model specifications of Japan 1996-2022 Published registered utility model applications of Japan 1994-2022</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)</p>		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2020-93546 A (THE GOODYEAR TIRE & RUBBER CO.) 18 June 2020 (2020-06-18) claims, paragraphs [0017], [0024]-[0026], fig. 5, 6	1-6
Y	WO 2015/115486 A1 (SUMITOMO RUBBER INDUSTRIES, LTD.) 06 August 2015 (2015-08-06) claims, paragraph [0044], examples, tables 2, 8, 9	1-6
A	JP 58-93612 A (THE GOODYEAR TIRE & RUBBER CO.) 03 June 1983 (1983-06-03) claims, fig. 2	1-6
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
<p>* Special categories of cited documents:</p> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p> <p>“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>“&” document member of the same patent family</p>		
Date of the actual completion of the international search		Date of mailing of the international search report
07 January 2022		18 January 2022
Name and mailing address of the ISA/JP		Authorized officer
Japan Patent Office (ISA/JP) 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915 Japan		Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2021/041856

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				EP	3666510	A2	
				CN	111319286	A	
WO	2015/115486	A1	06 August 2015	US	2016/0347127	A1	claims, paragraph [0051], examples, tables 2, 8, 9
				EP	3093165	A1	
				CN	105899377	A	
JP	58-93612	A	03 June 1983	US	4398583	A	claims, fig. 2
				EP	80968	A2	
				BR	8206440	A	
				CA	1188964	A	

REFERENCES CITED IN THE DESCRIPTION

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